Case Report

DOI: 10.7860/JCDR/2023/66271.18438

Multidisciplinary Approach in the Management of Maxillary Anterior Region Dental Trauma: A Case Report

Dentistry Section

DEEPSHIKHA MEHROTRA[1], RAJMOHAN Y SHETTY[2], AMARSHREE A SHETTY[3]

ABSTRACT

Traumatic Dental Injuries (TDIs) to the maxillary anterior teeth occur frequently in paediatric and adolescent populations. Prompt diagnosis, correct treatment planning, and a multidisciplinary approach are pertinent aspects of successfully managing multiple TDIs in a patient. The present case report of a 13-year-old female patient describes a multidisciplinary approach necessary to successfully manage dental trauma of an avulsed maxillary central incisor and a complicated crown fracture involving the maxillary left lateral incisor in an adolescent. The complicated crown-root fracture was treated with endodontic therapy, followed by the placement of a fibre-reinforced post, core build-up, and the cementing of a porcelain-fused-to-metal crown. Bone grafting with a mandibular symphysis block autograft, followed by prosthetic rehabilitation with transitional implants, was performed to restore the aesthetics, form, and function of the avulsed maxillary central incisors. The use of osseointegrated implants has gained wide acceptance in the adult population. However, due to concerns regarding growth, their use in the paediatric population is not as common. This accounts for a scarcity of clinical cases reported in the literature. There are no established guidelines for the placement of implants in growing patients. Thus, authors believe that the present case report contributes to the literature on this subject. The treatment of this complex, multi-dental injury in the maxillary anterior region of a young female required a holistic approach with a step-wise progressive, long-term treatment plan. Traumatic injuries in adolescent patients can adversely impact their oral health-related quality of life if not treated correctly.

Keywords: Avulsion, Bone grafting, Complicated crown fracture, Transitional implants

CASE REPORT

A 13-year-old female patient, accompanied by her parent, presented to the Department of Paediatric and Preventive Dentistry with a chief complaint of missing and fractured upper anterior teeth due to trauma one month ago. Further history revealed that the patient had fallen from her bicycle, resulting in trauma to the maxillary anterior region. The maxillary central incisors (11 and 21) were lost at the accident site. The medical history was unremarkable.

Clinical examination revealed the absence of the maxillary central incisors (11 and 21) and a horizontally complicated crown fracture with the maxillary left lateral incisor (22) [Table/Fig-1]. No mobility, tenderness on percussion and palpation, or response to electric and cold pulp tests were observed with tooth 22. Radiographic examination showed the absence of teeth 11 and 21 and a horizontal crown fracture (involving enamel, dentin, and pulp) with significant loss of crown structure in tooth 22. A diagnosis of avulsion was made for teeth 11 and 21, with a complicated crown fracture in tooth 22.

[Table/Fig-1]: Clinical presentation of patient.

To address the immediate aesthetic concerns, prosthetic rehabilitation of the missing teeth 11 and 21 involved fabricating a removable partial denture for the patient [Table/Fig-2]. Endodontic therapy was started and completed for tooth 22 during the same visit [Table/Fig-3].

[Table/Fig-2]: Prosthetic rehabilitation of the missing 11 and 21 with removable partial denture. **[Table/Fig-3]:** Endodontic therapy of 22. (Images from left to right)

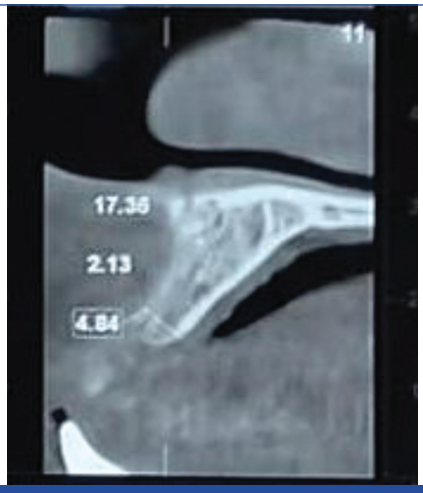
During the second visit, scheduled one week later, postspace preparation using Peeso reamer #3 was performed, followed by cementation of a fibre-reinforced post and core build-up in tooth 22. Subsequently, tooth 22 was prepared for a porcelain-fused-to-metal crown [Table/Fig-4]. The crown was cemented during the subsequent visit, scheduled one week later [Table/Fig-5].

Considering the patient's age, transitional implants were recommended as part of the treatment plan. A three-dimensional radiographic image {Cone Beam Computed Tomography (CBCT)} of the area of interest revealed a concavity on the buccal aspect of tooth 21 with insufficient buccolingual alveolar width (2.13 mm) for implant placement [Table/Fig-6].

A bone grafting procedure using a block graft from the mandibular symphysis (autograft) was planned. The procedure and expected outcomes were explained to the patient and her mother, and written consent was obtained. Local anaesthesia (2% lignocaine

[Table/Fig-4]: Composite resin core buildup of 22.

[Table/Fig-5]: Porcelain-fused-to-metal crown of 22 cemented.



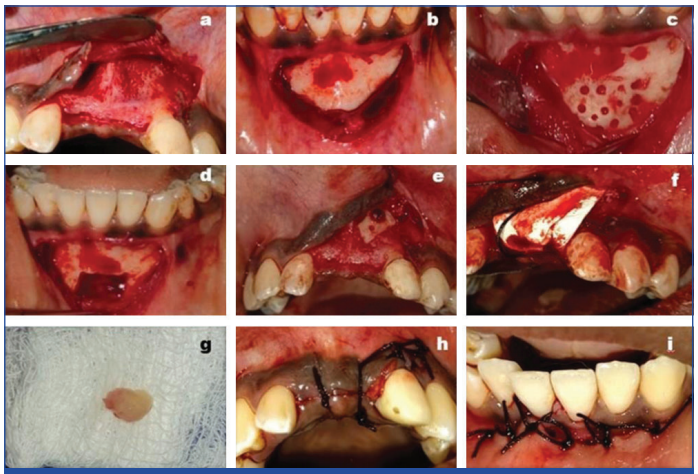
[Table/Fig-6]: CBCT revealing buccolingual alveolar width of 2.13 mm.

hydrochloride with epinephrine 1:200,000) was administered at the recipient and donor sites. At the recipient site, a horizontal incision was made from tooth 22 to tooth 12 at the mucogingival junction using a No. 11 blade. A full-thickness mucoperiosteal flap was raised, and the extent of the defect was assessed using a probe [Table/Fig-7a].

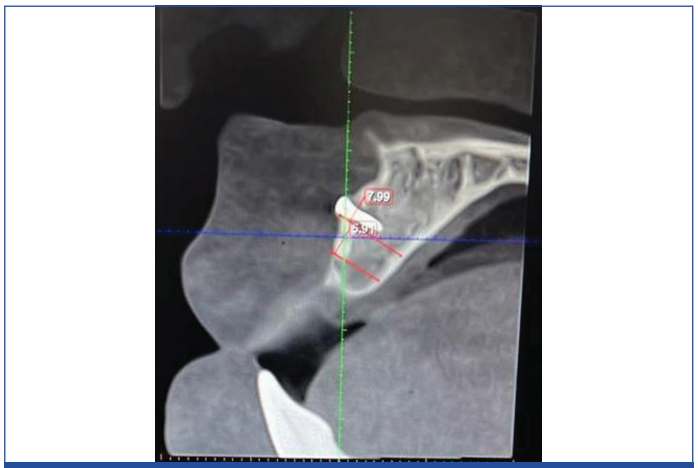
A vestibular incision was made 1 cm beyond the mucogingival junction, reaching the distal regions of the lateral incisors. This was followed by vertical relieving incisions on either side, and a full-thickness mucoperiosteal flap was elevated toward the base of the mandible [Table/Fig-7b]. The size of the graft was determined based on the measured defect size.

A round osteotomy bur and copious saline irrigation were used to outline the graft, which measured 6 mm in width, 4 mm in height, and 2 mm in thickness. The superior border of the graft was positioned 5 mm below the apex of the mandibular incisors to avoid accidental damage to the tooth roots during the osteotomy [Table/Fig-7c]. The osteotomy marks were joined using a fissurotomy bur, with continuous saline irrigation. A periosteal elevator and flat bone chisel were employed to separate the graft from the surrounding bone [Table/Fig-7d]. Decortication and perforation of the recipient site were performed to enhance the revascularisation process and improve the longevity of the graft. A pilot hole was drilled through the graft placed on the recipient site to facilitate the insertion of a 1 mm diameter and 6 mm long titanium screw for stabilisation, without resistance [Table/Fig-7e,f].

Platelet-Rich Fibrin (PRF) was prepared by drawing the patient's blood and centrifuging it at 12,000 rpm for 10 minutes [Table/Fig-7g] [1]. The PRF and bone grafting materials (Osseograft, Demineralised Bone Matrix (DMBM)-xenograft) were placed around the autogenous bone graft to fill the remaining gaps. A collagen membrane {PerioCol-Guided Tissue Regeneration (GTR)} was used to secure the graft material in position for guided bone regeneration [Table/Fig-7f]. Interrupted sutures were placed in the donor and recipient sites [Table/Fig-7h,i]. The patient was prescribed analgesics, antibiotics, a soft diet, and an antimicrobial mouth rinse (0.12% chlorhexidine) and scheduled for suture removal after one week. The suture removal was performed without complications, and the healing process was uneventful. Regular follow-up appointments were scheduled, and a CBCT scan was taken at six months to assess the changes in the alveolar bone at the grafting site. An increase in the buccolingual width (from 2.13 mm to 5.91 mm) and density of the alveolar bone indicated new bone formation [Table/Fig-8].



[Table/Fig-7]: (a) Full thickness flap raised at recipient site; (b) Full thickness flap raised at donor site; (c) Osteotomy marks at donor site; (d) Donor site after disengaging the block graft; (e) Block graft stabilised at recipient site; (f) Collagen membrane placed for guided bone regeneration; (g) Platelet-rich fibrin prepared; (h) Interrupted suture placed at recipient site; (i) Interrupted suture placed at donor site.

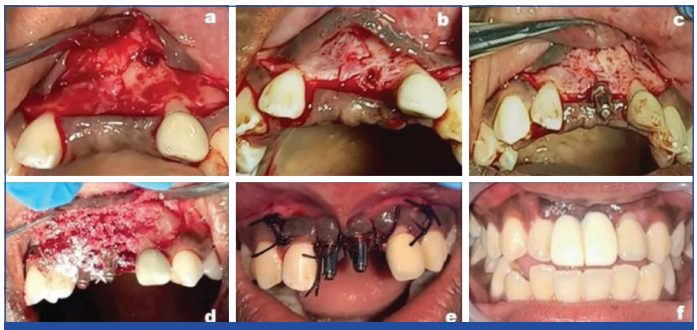


[Table/Fig-8]: Increase in alveolar bone thickness to 5.91 mm after 6 months of grafting.

Transitional implants were placed using a crestal incision in the regions of teeth 11 and 21. A mucoperiosteal flap was raised, and the previously inserted titanium screw used for graft stabilisation was removed [Table/Fig-9a]. Two implant lengths of 5 mm were drilled equidistant from each other, and adjacent teeth were drilled into the alveolar bone [Table/Fig-9b]. One-piece machined implants

(2.5×11 mm Provi™ Myriad implant system, Straumann) were implanted in the drilled slots, and a wrench was used to complete the final torquing of the implants [Table/Fig-9c]. Bone graft material (Osseograft, DMBM-xenograft) was placed around the implants, and interrupted sutures were used for closure [Table/Fig-9d,e]. The patient returned after one week for the cementation of acrylic crowns [Table/Fig-9f].

The patient is currently on a three-month follow-up schedule and has completed nine months of follow-up since implant placement [Table/Fig-10].



[Table/Fig-9]: (a) Crestal incision to expose implant placement site; (b) Preparation of implant site by drilling pilot hole; (c) Transitional implant placed in 21 region; (d) Transitional implant and bone grafting material placed in 11 region; (e) Interrupted sutures placed; (f) Acrylic crown cemented.

[Table/Fig-10]: At 9 month follow-up.

DISCUSSION

Traumatic tooth loss can result in alveolar resorption due to bone loss during the traumatic event or resorption of the alveolar crests after intraosseous triggering of the periodontal ligament apparatus [2]. It is critical to repair these defects in order to prevent further ridge loss and degeneration [3]. Removable partial dentures are the treatment of choice for substituting lost anterior teeth; however, they have the disadvantage of contributing to residual alveolar resorption [4]. Thus, the emphasis of treatment methods has shifted to other options such as implants.

Bone-implant contact can occur through fibro-osseous integration or osseointegration [5]. Definitive implants used in the adult population show osseointegration with the alveolar bone. However, they are contraindicated in the active growth stage as they are fixed to the bone and do not adjust with the growing bone. This can lead to occlusal discrepancies between the level of the implant crown and adjacent teeth [6].

Transitional implants, on the other hand, have fibro-osseous integration, which allows for easy removal in the future once the patient's growth is complete. They can be replaced without major deleterious effects due to their altered bone-implant contact [7].

Literature on the use of implants in the paediatric population is scarce and mainly focuses on children with conditions such as Ectodermal Dysplasia (ED), syndromes associated with tooth agenesis, and trauma [8]. Prosthetic rehabilitation using implant-supported overdentures is often required for patients with ED who have anodontia, hypodontia, or tooth agenesis [9]. Placement of implants in patients with ED has shown high predictability and positive clinical results. This includes improvements in masticatory capacity, quality of life, and phonetics, leading to increased self-esteem and social acceptability [10]. Transitional implants have an overall success rate of 89.8%, with the highest survival rate observed in the mandibular anterior region [11].

Transitional implants typically have a diameter of 1.8 to 2.8 mm and a length of 7 to 14 mm. They are mainly made of commercially pure titanium, which may undergo surface treatment or machining to enhance bone-to-implant contact [6]. Transitional implants provide enhanced retention, stability, and support for implant-supported fixed prostheses. They are used when immediate loading is not recommended, allowing for a healing interval before definitive implants can osseointegrate [12]. In addition to being cost-effective, they are simple, quick, easier to place, and provide immediate restoration of aesthetics, which can have psychological benefits. High success rates of 96.6% have been reported when extra-narrow diameter implants are placed in adolescent patients; no discrepancies were noted in the adjacent natural teeth and implant crown level [13].

The presence of sufficient bone is the primary requirement for dental implant placement. The use of reconstructive procedures to augment alveolar bone is a favoured choice for achieving the necessary alveolar density and thickness before the insertion of dental implants (definitive/transitional) [14]. There are numerous grafting methods available; however, autogenous grafts are regarded as the gold standard because they have a lower chance of graft rejection and tremendous osteoconductive and osteoinductive properties [15]. Intraoral donor graft sites are preferred as they reduce the morbidity in graft extraction while requiring shorter surgical and analgesic time. The mandible is an intramembranous cortical bone that provides better volume steadiness, less postoperative resorption, and increased revascularisation and healing [16]. Block grafts can be extracted from anatomical regions, and the symphysis allows easy access, a greater volume of bone, and minimal discomfort [17]. PRF is a dense fibrin scaffold consisting of platelets (97%) and leukocytes that release growth factors and help maintain the local availability of progenitor cells at the surgical site, thereby assisting in bone regeneration [18].

Preservation of traumatised teeth/tooth through more conservative approaches such as re-implantation, splinting, fragment reattachment, and endodontic procedures is desirable. Failure of early treatment of TDI can result in a poor prognosis necessitating extraction of the teeth. In such scenarios, prosthetic rehabilitation using mini-implants/transitional implants may be a suitable option in growing children [19]. Immediate placement of transitional implants into fresh extraction sites following dental trauma in paediatric adolescent patients has also been shown to be a predictable treatment strategy with a high survival rate of 95.7% over a three-year follow-up [20].

CONCLUSION(S)

Traumatic injuries in adolescent patients can have a significant impact on their oral health-related quality of life. Prompt diagnosis, treatment planning, and a multidisciplinary approach are essential for managing multiple traumatic dental injuries in a single patient. While there are no established guidelines for the placement of implants in growing patients, the consideration of this treatment modality should be approached with caution. Bone grafting procedures, where indicated, can be an important factor in the success of subsequent surgical phases of therapy, resulting in effective and aesthetically pleasing outcomes.

REFERENCES

[1] Radha V, Varghese SS, Ganesh MK. Stability of platelet-rich fibrin treated with tranexamic acid in vivo: A histological study in rats. World Journal of Dentistry. 2021;12(5):386-91.

[2] Tolstunov L, Hamrick JFE, Broumand V, Shilo D, Rachmiel A. Bone augmentation techniques for horizontal and vertical alveolar ridge deficiency in oral implantology. Oral Maxillofac Surg Clin North Am. 2019;31(2):163-91.
[3] Souza FÁ, Bassi APF, Araneg AM, Ponzoni D, Leonardi GB, Boos FBDJ, et al. Reconstruction of maxillary ridge atrophy caused by dentoalveolar trauma, using autogenous block bone graft harvested from chin: A case report. Journal of Osseointegration. 2014;6(2):21-27.
[4] Ozan O, Orhan K, Aksoy S, Icen M, Bilecenoglu B, Sakul BU. The effect of removable partial dentures on alveolar bone resorption: A retrospective study with cone-beam computed tomography. J Prosthodont. 2013;22(1):42-48.
[5] Rathi NV, Baliga S, Thosar NR, Bane SP, Bhansali P. Management of hypodontia patient using a transitional implant: A case report. Int J Clin Paediatr Dent. 2023;16(1):186-89.
[6] Hegde R, Sargod S, Baliga S, Raveendran R. Transitional dental implant in adolescent patient-A narrative review. J Indian Soc Pedod Prev Dent. 2021;39(4):347-52.
[7] Muhamad AH, Nezar W, Azzaldeen A. Managing congenitally missing lateral incisors with single tooth implants. Dent Oral Craniofac Res. 2016;2(4):318-24.
[8] Fernandes AP, Battistella MA. Dental implants in paediatric dentistry: A literature review. Brazilian Journal of Implantology and Health Sciences. 2020;2(2):01-02.
[9] Liu Y, Tang C. Interdisciplinary treatment with implant-supported prostheses for an adolescent with ectodermal dysplasia: A clinical report. J Prosthet Dent. 2020;123(5):655-60.
[10] Thomas C, Vaysse F, Courset T, Nasr K, Courtois B, L'Homme A, et al. From child to adulthood, a multidisciplinary approach of multiple microdontia associated with hypodontia: Case report relating a 15 year-long management and follow-up. Healthcare (Basel). 2021;9(9):1180.
[11] Casaña-Ruiz MD, Català-Pizarro M, Borrás-Aviñó C, Estrela-Sanchís MF, Bellot-Arcís C, Montiel-Company JM. Implants as a treatment alternative in children with multiple agnesia: Systematic review and meta-analysis. J Clin Exp Dent. 2023;15(4):e324-37.
[12] de Almeida EO, Filho HG, Goiatto MC. The use of transitional implants to support provisional prostheses during the healing phase: A literature review. Quintessence Int. 2011;42(1):19-24.
[13] Lambert F, Botilde G, Lecloux G, Rompen E. Effectiveness of temporary implants in teenage patients: A prospective clinical trial. Clin Oral Implants Res. 2017;28(9):1152-57.
[14] Flanagan D. Osseous remodeling around dental implants. J Oral Implantol. 2019;45(3):239-46.
[15] Schmidt AH. Autologous bone graft: Is it still the gold standard? Injury. 2021;52:S18-22.
[16] Harshakumar K, Varghese NM, Ravichandran R, Lylajam S. Alveolar ridge augmentation using autogenous block bone grafts harvested from mandibular ramus to facilitate implant placement: A case report. International Journal of Scientific Study. 2014;2(1):46-50.
[17] Bhandary M, Hegde AM, Shetty R, Shetty P. Augmentation of narrow anterior alveolar ridge using autogenous block onlay graft in a paediatric patient: A case report. Int J Clin Paediatr Dent. 2021;14(2):311-14.
[18] Mall S, Shetty R, Hegde A, Rai K. Platelet rich fibrin-A saviour for replanted teeth-A review. Journal of Evolution of Medical and Dental Sciences. 2021;10:2816-23.
[19] Munoz-Sanchez ML, Decerle N, Devoize L, Nicolas E, Cousson PY, Veyrune JL. Dental trauma management in a young teenager through endodontics and implantology: A case report. Healthcare (Basel). 2021;9(5):542.
[20] Hirani M, Moshtofar Z, Devine M, Paolinelis G, Djemal S. Survival of immediate implants replacing traumatised teeth in the anterior maxilla. Br Dent J. 2023;234(10):745.

PARTICULARS OF CONTRIBUTORS:
1. Postgraduate, Department of Paediatric and Preventive Dentistry, A B Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Deralakatte, Mangalore, Karnataka, India.
2. Professor, Department of Paediatric and Preventive Dentistry, A B Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Deralakatte, Mangalore, Karnataka, India.
3. Professor, Department of Paediatric and Preventive Dentistry, A B Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Deralakatte, Mangalore, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Rajmohan Y Shetty,
Professor, Department of Paediatric and Preventive Dentistry, A B Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Deralakatte, Mangalore-575018, Karnataka, India.
E-mail: rajmohanshetty4@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 30, 2023
- Manual Googling: Aug 19, 2023
- iThenticate Software: Aug 28, 2023 (9%)

ETYMOLOGY: Author Origin

EMENDATIONS: 5

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Jun 27, 2023**
Date of Peer Review: **Aug 18, 2023**
Date of Acceptance: **Aug 29, 2023**
Date of Publishing: **Sep 01, 2023**